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PROPOSED NEW CLAIMS

34. A piezo-electric transformer circuit, comprising: a piezo-electric transformer having mutually vibrationally coupled primary and secondary regions, the secondary region being operable to provide an output signal for use in generating an output from the circuit; and vibration exciting means for exciting the transformer into vibration to generate the output signal, the transformer including a hard piezo-electric material having a dielectric loss of substantially 0.005 or less at 1 kHz frequency.

35. The circuit according to claim 34, wherein the exciting means is operable for exciting vibrations at a frequency corresponding to a modal resonance of the primary and secondary regions.

36. The circuit according to claim 34, wherein the exciting means incorporates a network operable for phase shifting and amplifying the output signal to generate a drive signal for exciting and thereby sustaining vibrations within the transformer.

37. The circuit according to claim 36, wherein the network is operable for phase shifting the output signal in a range of 30° to 150° to generate the drive signal.

38. The circuit according to claim 36, wherein the network is operable for phase shifting the output signal in a range of 30° to 90° to generate the drive signal.

39. The circuit according to claim 34, wherein the exciting means incorporates amplifiers arranged in a bridge configuration operable for driving the transformer.

40. The circuit according to claim 34, wherein the exciting means is operable for exciting vibrations and incorporates at least one inductor through which the transformer is driven

at its primary region, the inductor being operable for electrically resonating with a capacitor provided by the primary region at a frequency corresponding to that of the vibrations.

41. The circuit according to claim 40, wherein said at least one inductor incorporates a ferrite core.

42. The circuit according to claim 34, and rectifying means for rectifying the output signal from the secondary region to provide the output from the circuit, the output being in a form of a unipolar output potential.

43. The circuit according to claim 42, wherein the rectifying means incorporates a rectifier diode operable for providing a conductive path for the output signal to a ground potential to assist with developing the unipolar output potential.

44. The circuit according to claim 36, wherein the transformer is operable for imparting a greater voltage amplitude to the output signal relative to that of the drive signal.

45. The circuit according to claim 34, wherein the transformer is operable for vibrating in a longitudinal mode of acoustic resonance.

46. The circuit according to claim 34, wherein the primary region of the transformer comprises a stack of mutually joined piezo-electric material elements, each element incorporating electrical connections and arranged to be excited in parallel with other of the elements.

47. The circuit according to claim 46, wherein the transformer incorporates in a range of 2 to 40 elements in the primary region, and a single element in the secondary region.

48. A method of operating a piezo-electric transformer, the method comprising the steps of:

a) forming the transformer with mutually vibrationally coupled primary and secondary regions, the secondary region providing an output signal from the transformer, and fabricating the transformer from a hard piezo-electric material having a dielectric loss of substantially 0.005 or less at 1 kHz; and

b) establishing a feedback network for processing the output signal to generate a drive signal, and applying the drive signal to excite oscillatory vibrations in the primary region which couple to the secondary region, thereby generating the output signal in the secondary region and sustaining the vibrations in the transformer.

49. The method according to claim 48, wherein the vibrations are sustained at a frequency corresponding to a modal resonance of the primary and secondary regions.

50. The method according to claim 48, and the steps of phase shifting and amplifying the output signal in the network to generate the drive signal.

51. The method according to claim 50, wherein the output signal is phase shifted in a range of 30° to 150° in the network to generate the drive signal.

52. The method according to claim 48, wherein the transformer is driven from amplifiers arranged in a bridge configuration.

53. The method according to claim 48, wherein the transformer is driven at its primary region through at least one inductor arranged to electrically resonate with a capacitor provided by the primary region at a frequency corresponding to that of the vibrations.

54. The method according to claim 53, wherein said at least one inductor incorporates a ferrite core.

55. The method according to claim 53, and extracting signals from the secondary region of the transformer through an inductor arranged to electrically resonate with a capacitor provided by the secondary region at a frequency corresponding to that of the vibrations.

56. The method according to claim 48, and rectifying the output signal to provide a unipolar output potential from the transformer.

57. The method according to claim 56, wherein the rectifying step is performed by directing the output signal through a rectifier diode to a ground potential, the diode being operative to provide a conductive path to assist with developing the unipolar output potential.

58. The method according to claim 48, wherein the transformer is of elongate form operable to vibrate longitudinally along an elongate axis.

59. The method according to claim 48, wherein the transformer is operable to impart a greater voltage amplitude to the output signal relative to the drive signal.

60. The method according to claim 48, wherein the transformer is operable to vibrate in a longitudinal mode of mechanical resonance.

61. The method according to claim 48, and forming the primary region with a stack of mutually joined piezo-electric material elements, each element incorporating electrical connections and arranged to be excited by the drive signal in parallel with other of the element.

62. The method according to claim 61, wherein the transformer incorporates in a range of 2 to 40 elements in the primary region, and a single element in the secondary region.

63. A personnel-wearable sensing apparatus operable for generating an elevated bias potential for use in the apparatus, the apparatus comprising a piezo-electric transformer circuit including a piezo-electric transformer having mutually vibrationally coupled primary and secondary

regions, the secondary region being operable to provide an output signal for use in generating an output from the circuit; and vibration exciting means for exciting the transformer into vibration to generate the output signal, the transformer including a hard piezo-electric material having a dielectric loss of substantially 0.005 or less at 1 kHz frequency.

64. A piezo-electric transformer, comprising: mutually vibrationally coupled primary and secondary regions, the primary region incorporating a stack of piezo-electric material elements, each element incorporating electrical connections for connecting a drive signal thereto, the secondary region incorporating electrical connections for extracting an output signal therefrom, and the transformer comprising a piezo-electric material having a dielectric loss of substantially 0.005 or less at 1 kHz.

65. The transformer according to claim 64, wherein the transformer incorporates in a range of 2 to 40 elements in the primary region, and a single element in the secondary region.

66. A personnel-wearable sensing apparatus, comprising: a piezo-electric transformer operable for generating a bias potential for use in the apparatus, the transformer including mutually vibrationally coupled primary and secondary regions, the primary region incorporating a stack of piezo-electric material elements, each element incorporating electrical connections for connecting a drive signal thereto, the secondary region incorporating electrical connections for extracting an output signal therefrom, and the transformer comprising a piezo-electric material having a dielectric loss of substantially 0.005 or less at 1 kHz.